the tested sample's exponential fit equation constants with stored values of fit equation constants of different reactants can be done and the output will identify the reactant tested.

As an additional embodiment, the microprocessor may be programmed by common methods to determine if the tested reactant's curve is a superposition of two or more reactants curves. If so, further tests can be done to determine the ethanol alcohol content in the subject. Also, the microprocessor can calculate and compare the tested sample's curve and its deviation from the target reactant or reactants' curves. If it meets a predetermined level of what deviation is acceptable, then the microprocessor finishes the desired calculations and determines the values desired.

CLAIMS

1. A method of determining the quantity of an electrochemically convertible substance in a gas sample, the method comprising the steps of:

(a) introducing said gas into an electrochemical sensor wherein said gas is electrochemically converted producing an electrical output;

(b) measuring said output at three or more predetermined time intervals;

(c) using said measurements to calculate the constants of a curve-defining equation with two or more exponential terms, each with constant factors a or b: (b) is the reaction factor and (a) is the discharge factor of the electrochemical sensors reaction with the reactant and (k) is an amplitude factor of the equation being of the general form, $y(t) = k \times (e^{-axt} - e^{-bxt})$; and

(d) determining the quantity of said substance by integrating under all or part of the curve defined by said equation.

2. The method of claim 1 wherein the equation is integrated between times that are defined by output levels of the curve.

3. The method of claim 1 wherein the equation is integrated between times that are defined by multiples of the peak time.

4. The method of claim 1 wherein the equation is integrated between zero and infinite time.

5. The method of claim 1 wherein the said substance is ethanol.

6. The method of claim 1 wherein the constants in said equation are calculated using said measurements at time t, time 2t, and time 4t.

7. A method of identifying an electrochemically convertible substance in a gas sample, the method comprising the steps of:

(a) introducing said gas into an electrochemical sensor wherein said gas is electrochemically converted producing an electrical output;

(b) measuring said output at three predetermined time intervals;

(c) using said measurements to calculate the constants of a curve-defining equation with two or more exponential terms, each with constant factors a or b: (b) is the reaction factor and (a) is the discharge factor of the electrochemical sensors reaction with the

reactant and (k) is an amplitude factor of the equation being of the general form, $y(t) = k \times (e^{-axt} - e^{-bxt})$;

(d) comparing the curve of the sample to the specimen curves of one or more selected reactants; and

(e) determining if the sample contains one or more of the selected reactants or is contaminated by other reactants.

8. The method of claim 7 wherein the said substance is an alcohol.

9. The method of claim 7 wherein the said parameters are calculated using said measurements at time t, time 2t, and time 4t.

10. A method of determining characteristic parameters of the electrochemical sensor output produced by the oxidation of an oxidizable substance in a gas when the output is represented by an equation of two or more exponential terms of the general form $y(t) = k \times (e^{-axt} - e^{-bxt})$ where (b) is the reaction factor and (a) is the discharge factor and (k) is the amplitude factor said method comprising the steps of:

(a) introducing said gas containing said oxidizable gas substance into said sensor wherein said substance is electrochemically converted producing an electrical output;

(b) measuring said output at three predetermined time intervals;

(c) using said measurements to calculate the constants of a curve-defining equation; and

(d) using said measurements to calculate said characteristic parameters.

11. The method of claim 10 wherein the said characteristic parameter is the time at which the curve defined by said equation peaks.

12. The method of claim 10 wherein said characteristic parameter is the approximate fuel cell output level for a given time.

13. The method of claim 10 wherein said characteristic parameter is the time at which the fuel cell reaches a given output level.

14. The method of claim 10 wherein the said substance is ethanol.

15. The method of claim 10 wherein the said characteristic parameters are calculated using said measurements at time t, time 2t, and time 4t.

16. The method for expressing the output of a fuel cell sensor for analyzing an alcohol containing gas is a curve defining equation where (b) is the reactant factor and (a) is the discharge factor of the fuel cell and specific alcohol and (k) is the amplitude factor of a curve defining equation $y(t) = k \times \left(e^{-axt} - e^{-bxt}\right)$.

17. A method of determining the alcohol content of a breath sample using a fuel cell apparatus which produces a varying current output over a period of time as a function of the alcohol content of said sample, and producing a reaction current as a function of time according to a curve-defining equation with two or more exponential terms, each with constant factors, the reaction factor (b) and the discharge factor (a) of the electrochemical sensor's

reaction with the reactant and an amplitude factor (k) the equation being of the general form, $y(t) = k \times (e^{-axt} - e^{-bxt})$;

(a) feeding said sample to said fuel cell apparatus;

(b) measuring and determining a current output from said apparatus at times t, 2t, and 4t;

(c) calculating the parameters of said fuel cell using said times and measured current outputs in said equation; and

(d) integrating said equation thus defined to determine the area under a curve defined thereby, said area being proportionate to the alcohol content of said breath sample.

18. A method of determining the alcohol content of a human breath comprising the steps of:

(a) using a sensor to oxidize a sample of said breath and produce an output current;

(b) measuring said current at three times t, 2t, and 4t; and

(c) using a computer to solve the equation $y(t) = k \times (e^{-axt} - e^{-bxt})$ using said currents and times to determine the factors a, b, and k where (b) is the reaction rate and (a) is the discharge rate of the sensor's reaction with the alcohol and k is the amplitude factor in said equation; and

(d) integrating said equation to determine the area thereunder between selected limits, said area being representative of said alcohol content.

19. A method as defined in claim 18 wherein said limits of integration are 0 and infinity, and said integral is calculated according to the equation $y(t) = k \times (e^{-axt} - e^{-bxt})$.

20. A method of determining the quantity of an oxidizable substance in a gas sample comprising the steps of:

(a) oxidizing in an electronic sensor a quantity of said substance present in said sample of said gas, said sensor producing measurable currents over periodic time intervals;

(b) measuring said currents at three periodic time intervals t, 2t, ~~2~~and 4t;

(c) using said periodic current measurements to determine the factors a, b, and k of an oxidation equation $y(t) = k \times \left(e^{-axt} - e^{-bxt}\right)$ where (b) is the reaction factor of said sensor, (a) is the discharge factor of said sensor, and (k) is the amplitude factor; and

(d) integrating said equation between defined limits to determine the area thereunder as a measure of the quantity of said substance in said sample within said defined limits.

21. A method as defined in claim 20 wherein said oxidizable substance is an alcohol.

22. A method as defined in claim 20 wherein said oxidizable substance is ethanol.

23. A method as defined in claim 20 wherein said oxidizable substance is a mixture of alcohols.